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Nutrition and the Prevalence of Dementia in Mainland China, Hong Kong, and Taiwan: An Ecological Study

Yu-Tzu Wu[a,*], William B. Grant[b], A. Matthew Prina[c], Hsin-yi Lee[d] and Carol Brayne[a]
[a]*Department of Public Health and Primary Care, Institute of Public Health, Forvie Site, University of Cambridge, School of Clinical Medicine, Cambridge Biomedical Campus, Cambridge, UK*
[b]*Sunlight, Nutrition, and Health Research Center, San Francisco, CA, USA*
[c]*King's College London, Institute of Psychiatry, Centre for Global Mental Health, Health Service and Population Research Department, De Crespigny Park, Denmark Hill, London, UK*
[d]*Luke International (Norway) - Malawi Office, Mzuzu, Malawi*

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Abstract.
Background: Western diets are associated with obesity, vascular diseases, and metabolic syndrome and might increase dementia risk in later life. If these associations are causal, those low- and middle-income countries experiencing major changes in diet might also see an increasing prevalence of dementia.
Objective: To investigate the relationship of dietary supply and the prevalence of dementia in mainland China, Hong Kong, and Taiwan over time using existing data and taking diagnostic criteria into account.
Methods: Estimated total energy supply and animal fat from the United Nations was linked to the 70 prevalence studies in mainland China, Hong Kong, and Taiwan from 1980 to 2012 according to the current, 10 years, and 20 years before starting year of investigation. Studies using newer and older diagnostic criteria were separated into two groups. Spearman's rank correlation was calculated to investigate whether trends in total energy, animal fat supply, and prevalence of dementia were monotonically related.
Results: The supply of total energy and animal fat per capita per day in China increased considerably over the last 50 years. The original positive relationship of dietary supply and dementia prevalence disappeared after stratifying by newer and older diagnostic criteria and there was no clear time lag effect.
Conclusion: Taking diagnostic criteria into account, there is no cross-sectional or time lag relationship between the dietary trends and changes in dementia prevalence. It may be too early to detect any such changes because current cohorts of older people did not experience these dietary changes in their early to mid-life.

Keywords: China, ecological study, prevalence of dementia, nutrition

INTRODUCTION

Disease conditions found directly correlated with risk of dementia and cognitive impairment include cardiovascular disease [1, 2], type 2 diabetes mellitus [3–5], metabolic syndromes [6], general obesity [5, 7], and abdominal obesity [8]. Diet can play a major role in the risk of these conditions and diseases. In particular, Western diet, high intake of red meat, saturated fats, sugar, and carbohydrates could have a potential impact on increasing the risk of cognitive impairment and dementia in older age [9].

With economic and social development, people in low and middle income countries have experienced substantial changes in lifestyle and dietary habits. With a rapidly increasing life expectancy across the globe, the emerging burden of non-communicable diseases and dementia has become an important issue. Popkin has published several papers on the health effects of the

*Correspondence to: Yu-Tzu Wu, Department of Public Health and Primary Care, Institute of Public Health, Forvie Site, University of Cambridge, School of Clinical Medicine, Cambridge Biomedical Campus, Cambridge CB2 0SR, UK. Tel.: +44 1223 330321; E-mail: ytw22@medschl.cam.ac.uk.

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nutrition transition from traditional diets to the Western diet with some attention to China [10–12]. Studies done in Northeast China, Southern China, and Shanghai documented the rising prevalence of general obesity and central obesity over a ten year period [13–15]. Results from a nationally representative cross-sectional survey in China showed that Western dietary patterns were significantly associated with increased likelihood of metabolic syndrome, obesity, and hypertension in Chinese populations [16, 17].

Recent studies have reported associations between diabetes, obesity, and dementia among the older people in China [18, 19]. An association between meat consumption and higher risk of dementia in low- and middle-income countries has been reported [20]. A potential increasing trend of dementia prevalence in Japan has been associated with nutrition transition and Western diet [21]. Changes in traditional dietary habits could have a potential impact on the prevalence of dementia in older populations of East Asian countries. Some indicators of Western diet such as the increasing intake of animal fat and total energy might be associated with an increasing prevalence of dementia over time. The impact of Western diet would be expected to have a time lag effect on the prevalence of dementia and thus the period of exposure could vary across generations. Dietary change at younger age could have cumulative influence throughout life-course and increase the risk of dementia in older age [22].

This study builds on the previous systematic review of dementia prevalence in mainland China, Hong Kong, and Taiwan [23]. The nutrition data from the Food and Agriculture Organization (FAO) of the United Nations was linked to the prevalence data to explore the relationship of dietary supply and prevalence of dementia over time.

METHODS

Prevalence of dementia

A detailed literature search of prevalence studies in mainland China, Hong Kong, and Taiwan was reported in full elsewhere but it is briefly summarized here [23]. An electronic search was conducted in three English (PubMed, ScienceDirect, and PsycInfo) and two Chinese databases (Chinese National Knowledge Infrastructure and Airti Library) to identify the literature related to "prevalence/epidemiology" and "dementia/Alzheimer" in mainland China, Hong Kong, and Taiwan ("China/Chinese/Taiwan/Taiwanese") from 1980 to 2012. Both traditional and simplified characters were used to search the Chinese database. The following inclusion criteria were used to select papers: (1) cases were collected by field survey, not based on hospital data, (2) the study involved population sampling rather than recruited volunteer participants, (3) the study reported prevalence in the people aged 50 and over, and (4) dementia case was not decided only by a screening test and the specific instruments and criteria for case identification were reported. Studies were excluded if they were: (1) duplicate, (2) irrelevant or with other focuses (such as behavioral psychological symptoms of dementia, dependency in older populations), (3) the results of follow-up waves, and (4) those which focused on Chinese populations outside mainland China, Hong Kong, and Taiwan.

Details of each study, such as methodological factors (screening tools, diagnostic criteria, and instruments), characteristics of the study population (sample size and response rate, the whole study age range and location) and results (overall prevalence of all type dementia and stratified prevalence by age) were extracted systematically by two readers with double verification. Disagreements between the two readers were reconciled through discussion to arrive at a consensus.

If there was no clear information about year of investigation in the paper, publication year minus three years was used as an approximation for the survey date, since the median time between beginning year of investigation and publication year was three years in the rest of the studies. The prevalence of dementia was standardized to the Chinese population in census 2011. Since diagnostic criteria can substantially influence prevalence estimates, the studies was divided into two groups: older (DSM-III/-III-R, ICD, CCMD and mixed) and newer (DSM-IV/-IV-R, 10/66 algorithm and GMS-AGECAT) diagnostic criteria.

Nutrition data

Dietary supply data was obtained from the Food and Agriculture Organization (FAO) of the United Nations and used as a proxy of dietary supply [24]. Per capita dietary supply data are available for many dietary components from 1961 to 2009. The annual data of dietary supply including total energy supply (kcal/capita/day) and animal fat (g/capita/day) was linked to the 76 prevalence studies in mainland China, Hong Kong, and Taiwan based on the starting year of investigation. To consider the potential influence of dietary in earlier years on dementia in later life, estimated total energy supply and animal fat in the past 10 and 20 years of

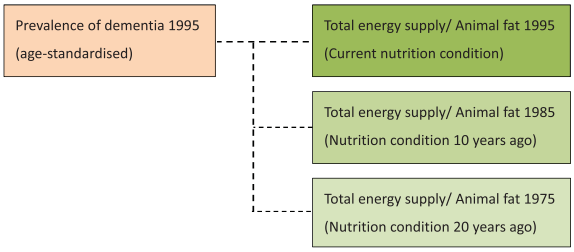

Fig. 1. The data linkage of nutrition and prevalence of dementia.

investigation were also connected to the prevalence of dementia (Fig. 1).

Increasing prevalence of dementia is generally associated with population aging and extended life expectancy. Life expectancy also reflects overall health status of populations, economic and social development in different countries. Information on life expectancy from 1949 (the end of China civil war) to 2012 was obtained from the Gapminder, a database which collects several indicators related to demographics, society, wealth and health of nations over time (http://www.gapminder.org).

Analysis

The analysis first explored time trends in dietary supply data (1961∼2009) and life expectancy in China. Dietary supply and life expectancy in Japan were also included to compare the difference between developing and developed countries [21].

The estimates of dementia prevalence are strongly influenced by diagnostic criteria. In this study, the two groups of "newer" and "older" diagnostic criteria were applied to this study [25, 26]. Newer criteria included the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), 10/66 diagnostic algorithm (10/66), and Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy (GMS-AGECAT). The studies using newer criteria are more likely to report significantly higher prevalence than older criteria, such as Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III), the International Classification of Diseases 10th (ICD-10), Chinese Classification of Mental Disorders (CCMD), and mixed diagnostic criteria [23]. Although GMS-AGECAT is more equivalent to DSM-III-R and is older than ICD-10, it has been used as a newer diagnostic method in mainland China [27]. The analysis was separated into two groups: older criteria (DSM-III, -III-R, ICD-10, CCMD, and mixed) and newer criteria (DSM-IV, -IV-R, 10/66, and others). Spearman's rank correlation was calculated to investigate whether trends in total energy, animal fat supply and prevalence of dementia were monotonically related. Contemporary and time lag relationships of dementia prevalence and nutrition supply (current, 10 years, and 20 years) were investigated in this study. To further consider uncertainty of the prevalence estimates, a sensitivity analysis was conducted using meta-regression and taking diagnostic criteria and study age range into account.

RESULTS

Trends in dietary supply, life expectancy, and the prevalence of dementia

The total energy supply per capita per day in China increased from below 1500 kcal in 1961 to over 3000 kcal in 2009 (Fig. 2A). The total food supply in Japan remained 2500 kcal and above since 1961,

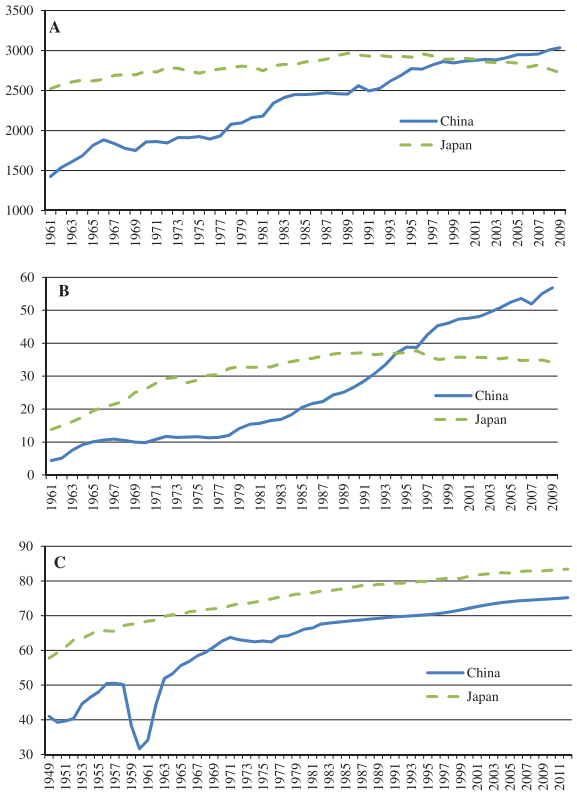

Fig. 2. A) Total energy supply (kcal/capita/day) from 1961 to 2009 by China and Japan. B) Animal fat (g/capita/day) from 1961 to 2009 by China and Japan. C) Life expectancy (years old) of China and Japan from 1949 to 2012.

while in China it was below 2000 kcal, the recommended daily energy supply, before 1980s. The supply of animal fat per capita per day in China remained substantially lower than Japan in 1960s and 1970s and increasing dramatically in the mid-1980s (Fig. 2B). After 1995, the supply of animal fat in China exceeded Japan, which had relatively stable supply over time. Trends in life expectancy at birth in China and Japan have been quite different (Fig. 2C). Life expectancy in Japan has been over 60 years since the 1950s and reached 83 in 2012. In China, life expectancy dropped to around 30 years old in 1958 to 1960 during the Great Famine and reached 70 years old by the mid-1990s.

Although some recent reviews report an increasing trend in the prevalence of dementia in China, our review did not find significant variation across time periods after controlling for methodological factors [25, 28, 29]. Not taking study methodology into account, the age-standardized estimates of dementia prevalence in mainland China, Hong Kong, and Taiwan increased from earlier to more recent years (Fig. 3), but after stratifying by newer and older diagnostic criteria, the prevalence of dementia fluctuated over time without a clear trend.

The association between dietary supply and prevalence of dementia over time

Fig. 3 shows the estimated supply of animal fat per capita per day and the prevalence of dementia in the same year. The supply of animal fat increased considerably over time. On the other hand, the change in dementia prevalence was small and there was a wide range of prevalence estimates in the same time periods (Fig. 4). It was unlikely to find a time lag effect since the prevalence remained stable over time.

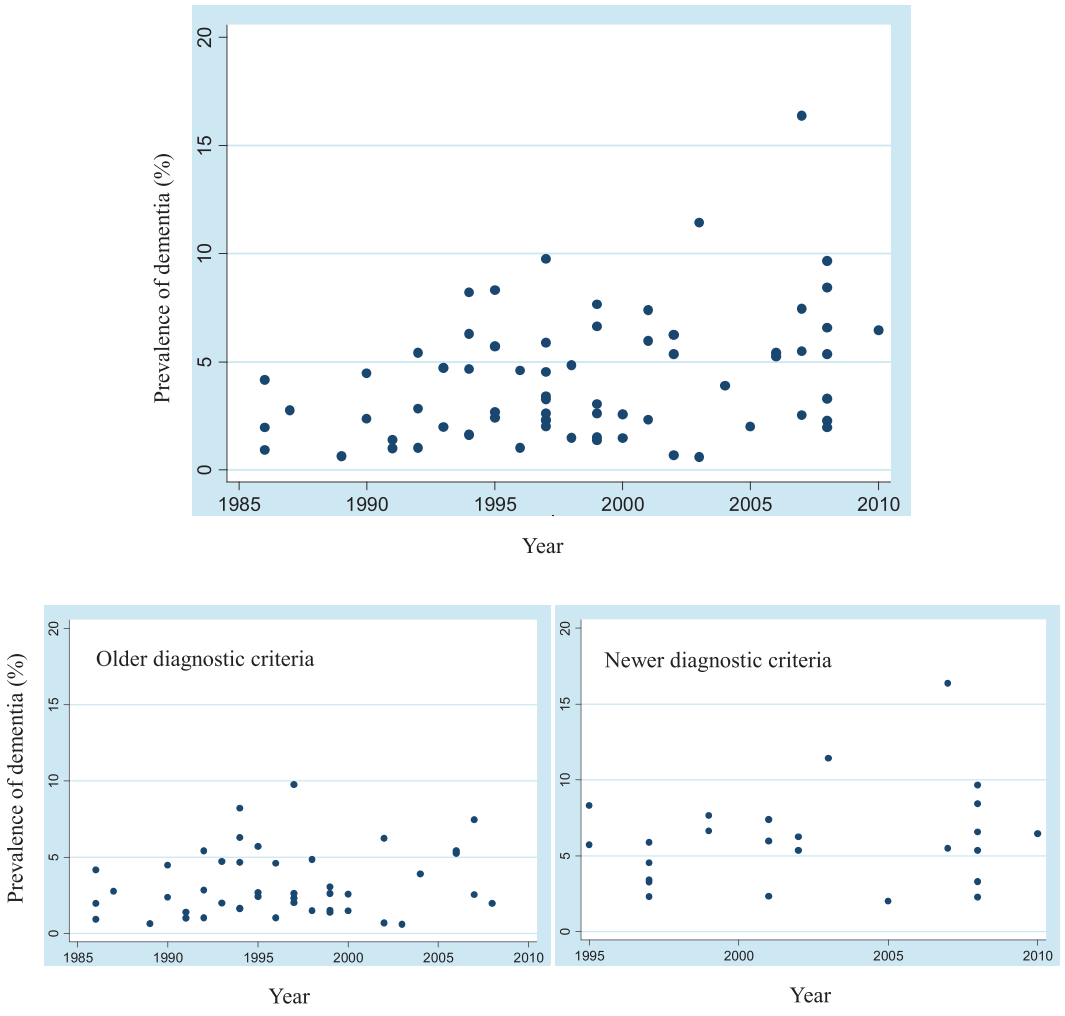

Fig. 3. Prevalence of dementia (%) over time by diagnostic criteria.

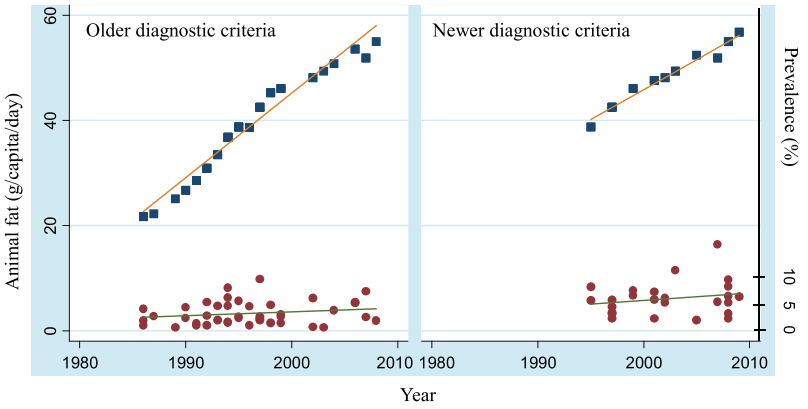

Fig. 4. Nutrition and prevalence of dementia in same years (Square: animal fat; Circle: prevalence of dementia).

Table 1
The correlation between energy intake, animal fat and prevalence of dementia over time (Spearman correlation coefficient)

Nutrition	Total energy intake (kcal/capita/day)			Animal fat (g/capita/day)		
	Overall	Stratified by diagnostic methods		Overall	Stratified by diagnostic methods	
	Coefficient (p)	Older Coefficient (p)	Newer Coefficient (p)	Coefficient (p)	Older Coefficient (p)	Newer Coefficient (p)
Current	0.37 (<0.01)	0.22 (0.15)	0.12 (0.57)	0.36 (<0.01)	0.20 (0.21)	0.11 (0.60)
Previous 10 years	0.35 (<0.01)	0.20 (0.20)	0.05 (0.83)	0.36 (<0.01)	0.19 (0.24)	0.14 (0.51)
Previous 20 years	0.37 (<0.01)	0.22 (0.19)	0.18 (0.38)	0.37 (<0.01)	0.21 (0.19)	0.21 (0.31)

There was a positive relationship between the supply of total energy, animal fat, and the prevalence of dementia (Table 1). The prevalence of dementia and dietary supply both increased over time. However, the relationship did not survive when changes in diagnostic criteria taken into account. There was no clear association between the dietary and prevalence of dementia over time. Similarly, the relationship of time lag dietary supply (10 or 20 years before the starting year of investigation) and dementia prevalence became ambiguous after stratifying by newer and older diagnostic criteria. The results showed that there was no clear time lag effect. The results of sensitivity analysis using meta-regression were similar to Spearman's rank coefficient (Supplementary Table 1). The strength of association reduced considerably after taking diagnostic criteria and study age range into account.

DISCUSSION

Main findings

This is an ecological study which explored the association between changes in dietary intake and prevalence of dementia over time. The intake of total energy and animal fat per capita per day increased considerably over last 50 years in China. The positive relationship between the intake of total energy, animal fat, and prevalence of dementia disappeared after stratifying by newer and older diagnostic criteria.

Limitations

The FAO data provided overall estimates for the quantity and energy of various types of food in different time periods. The statistics of agriculture production, stock, import/export, and wastes were used to estimate average food supply for each person per day. The data provides important information for problems of under nutrition in the world and the opportunities of comparing the variation between different countries and the change across time periods. However, it only provides approximate information of dietary intake. In low and middle income countries where food supply is more unstable, the dietary intake, food choices, and eating behaviors could be substantially different between socioeconomic groups and geographical areas. As animal fats consumption was reported as a single variable in the FAO data, we were not able to investigate the effects of different fats. Review studies found that saturated fatty acids correlated with increased risk of dementia, while both monounsaturated fatty acids and polyunsaturated fatty acids were inversely correlated

with risk of dementia [30–32]. Despite the disadvantage of the FAO data, this study did not use the government statistics from China. Data on agriculture production and food supply were sensitive information at the time for the Chinese government, who promised to improve the living conditions of large populations of farmers, laborers, and soldiers in the "new Chinese society". Providing sufficient food supply for the considerable Chinese population was one of the most important aims in several policies and campaigns, such as the Great Leap Forward. Therefore, the governmental statistics in early years were more likely to report inflated numbers related to agriculture, food, and nutrition.

Geographical variation of dementia prevalence across mainland China, Hong Kong, and Taiwan was reported in our previous study [23]. Eating habits in China vary a great deal across different regions. People in urban areas with high economic development are more likely to be exposed to Western diets while those living in rural areas might retain a more traditional dietary pattern. However, limited sample size restricts our ability to explore geographical variation and rural/urban differences in the association between dietary patterns and dementia prevalence. The characteristics of study populations, such as education, occupation, and living in urban/rural areas, might influence both eating habits throughout life and dementia risk in later life. This ecological study cannot investigate these aspects of heterogeneity as these data were incomplete or incomparable across individual studies.

The difference between China and Japan

Compared to the previous study in Japan, the potential relationship of nutrition transition and the prevalence of dementia was ambiguous in mainland China, Hong Kong and Taiwan and substantially explained by methodological differences. Based on the recommended daily energy intake (2000 kcal for women, 2500 kcal for men), the average of food supply in China before 1980 was not enough for an adult to live healthily, particularly for farmers, laborers, and soldiers, who needed even higher energy intake than others. Furthermore, the Great Famine between 1959 and 1961 caused serious food shortages and decreased life expectancy to nearly 30 years old (Fig. 2C). Absolute deprivation of food can lead to substantial deaths at earlier ages. In these extreme conditions, considerable inequality of food supply was likely to be an important issue. People who were able to survive to older age are more likely to have had stable and sufficient food resource; otherwise they would have been more likely to die due to under nutrition. Although there are considerable changes in the overall population, it might not reflect food intake of these people, who were more likely to survive and participate in the prevalence studies of dementia in later life. Without considering fundamental differences in these two countries, change in food supply might be over-estimated in the Chinese populations as most people lived in such a deprived situation. Similar problems were found in the supply of animal fat, which is considered to be related to a pattern of Western diet consumption. There was nearly no change in mainland China before 1980 and the dramatic increase in the1980s might only have impacted a small group of people.

High-income countries in East Asia have faced serious burdens of chronic diseases, such as diabetes, hypertension, and cardiovascular diseases, and extended life expectancy. Although this study did not find a time lag effect of dietary changes, the trend of Western diet does increase the risk of non-communicable diseases and may therefore increase the prevalence of dementia in older age [10–12]. Although we report the prevalence of dementia in China to be stable over the last 20 years, it is expected that the prevalence could increase substantially due to the increasing burden of non-communicable diseases.

Other potential risk factors

With dramatic economic development and societal changes, many Chinese populations have experienced different living conditions and lifestyle over the last decades. During the Great Leap Forward and the Cultural Revolution in the 1960∼1970s, the education system in China was intermitted and only recovered in the late 1970s. With the dissolution of the people's commune, the health system was extensively reformed in the 1980s and infant mortality gradually improved, infectious diseases came under control, and life expectancy lengthened. In the same period, economic developments have had enormous impacts on many lifestyle factors such as smoking, alcohol consumption, and physical activity as well as dietary habits. These factors are generally considered to be related to obesity, vascular diseases, and metabolic syndrome. The increasing prevalence of these non-communicable diseases has been reported in recent studies [13–17]. Since industrialization is a policy priority of the Chinese government, air pollution, particularly atmospheric particulate matter loadings, are very high in the urban areas of China [33]. Small particulate matter is

also considered to be a risk factor for cardiovascular disease and cognitive dysfunction [34–36].

These substantial societal changes mainly occurred in the 1970∼1980s and might have a stronger impact on lifestyle and living environments of the generations born after the late 1960s throughout their younger and middle age. Although several lifestyle factors including Western diet are considered to be related to the rising prevalence of non-communicable and the occurrence of dementia in later life, the cohorts which have experienced such dramatic changes have not yet reached older age. Most of the existing studies of dementia prevalence were conducted in 1990s and therefore unlikely to detect the potential influence of those societal changes on dementia occurrence.

CONCLUSION

This study did not find the cross-sectional or time lag relationships between changes in dietary supply and the prevalence of dementia in mainland China, Hong Kong, and Taiwan taking diagnostic criteria into account. Considering the lack of food in earlier eras in China, the later impact of increased Western diet might not be influencing current older people. It may be too early to detect any such changes because the current cohorts of older people did not experience these major lifestyle changes in their early to mid-life.

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Authors' disclosures available online (http://www.j-alz.com/disclosures/view.php?id=2593).

SUPPLEMENTARY MATERIAL

The supplementary material is available in the electronic version of this article: http://dx.doi.org/10.3233/JAD-141926.

REFERENCES

[1] de la Torre JC (2013) Vascular risk factors: A ticking time bomb to Alzheimer's disease. *Am J Alzheimers Dis Other Demen* **28**, 551-559.

[2] Ferreira LK, Tamashiro-Duran JH, Squarzoni P, Duran FL, Alves TC, Buchpiguel CA, Busatto GF (2014) The link between cardiovascular risk, Alzheimer's disease, and mild cognitive impairment: Support from recent functional neuroimaging studies. *Rev Bras Psiquiatr*, doi:10.1590/1516-4446-2013-1275

[3] De Felice FG, Ferreira ST (2014) Inflammation, defective insulin signaling, and mitochondrial dysfunction as common molecular denominators connecting type 2 diabetes to Alzheimer disease. *Diabetes* **63**, 2262-2272.

[4] Jayaraman A, Pike CJ (2014) Alzheimer's disease and type 2 diabetes: Multiple mechanisms contribute to interactions. *Curr Diab Rep* **14**, 476.

[5] Norton S, Matthews FE, Barnes DE, Yaffe K, Brayne C (2014) Potential for primary prevention of Alzheimer's disease: An analysis of population-based data. *Lancet Neurol* **13**, 788-794.

[6] Watts AS, Loskutova N, Burns JM, Johnson DK (2013) Metabolic syndrome and cognitive decline in early Alzheimer's disease and healthy older adults. *J Alzheimers Dis* **35**, 253-265.

[7] Letra L, Santana I, Seiça R (2014) Obesity as a risk factor for Alzheimer's disease: The role of adipocytokines. *Metab Brain Dis* **29**, 563-568.

[8] Zeki Al Hazzouri A, Haan MN, Whitmer RA, Yaffe K, Neuhaus J (2012) Central obesity, leptin and cognitive decline: The Sacramento Area Latino Study on Aging. *Dement Geriatr Cogn Disord* **33**, 400-409.

[9] Alzheimer's Disease International (2014) Nutrition and dementia: A review of available research. Available: http://www.alz.co.uk/sites/default/files/pdfs/nutrition-and-dementia.pdf

[10] Popkin BM, Horton S, Kim S, Mahal A, Shuigao J (2001) Trends in diet, nutritional status, and diet-related noncommunicable diseases in China and India: The economic costs of the nutrition transition. *Nutr Rev* **59**, 379-390.

[11] Popkin BM (2008) Will China's nutrition transition overwhelm its health care system and slow economic growth? *Health Aff (Millwood)* **27**, 1064-1076.

[12] Popkin BM, Adair LS, Ng SW (2012) Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev* **70**, 3-21.

[13] Wang H, Wang J, Liu MM, Wang D, Liu YQ, Zhao Y, Huang MM, Liu Y, Sun J, Dong GH (2012) Epidemiology of general obesity, abdominal obesity and related risk factors in urban adults from 33 communities of Northeast China: The CHPSNE study. *BMC Public Health* **12**, 967.

[14] Hou X, Liu Y, Lu H, Ma X, Hu C, Bao Y, Jia W (2013) Ten-year changes in the prevalence of overweight, obesity and central obesity among the Chinese adults in urban Shanghai, 1998-2007 - comparison of two cross-sectional surveys. *BMC Public Health* **13**, 1064.

[15] Lao XQ, Ma WJ, Sobko T, Zhang YH, Xu YJ, Xu XJ, Yu DM, Nie SP, Cai QM, Xia L, Thomas GN, Griffiths SM (2014) Overall obesity is leveling off while abdominal obesity continues to rise in a Chinese population experiencing rapid economic development: Analysis of serial cross-sectional health survey data 2002–2010. *Int J Obes*, doi: 10.1038/ijo.2014.95

[16] He Y, Li Y, Lai J, Wang D, Zhang J, Fu P, Yang X, Qi L (2013) Dietary patterns as compared with physical activity in

relation to metabolic syndrome among Chinese adults. *Nutr Metab Cardiovasc* **23**, 920-928.
[17] Sun J, Buys NJ, Hills AP (2014) Dietary pattern and its association with the prevalence of obesity, hypertension and other cardiovascular risk factors among Chinese older adults. *Int J Environ Res Public Health* **11**, 3956-3971.
[18] Chang WS, Won KH, Lee JY, Kim ET, Kweon HJ (2012) The relationship between obesity and the high probability of dementia based on the body mass index and waist circumference. *Korean J Fam Med* **33**, 17-24.
[19] Fei M, Yan Ping Z, Ru Juan M, Ning Ning L, Lin G (2013) Risk factors for dementia with type 2 diabetes mellitus among elderly people in China. *Age Ageing* **42**, 398-400.
[20] Albanese E, Dangour AD, Uauy R, Acosta D, Guerra M, Guerra SSG et al. (2009) Dietary fish and meat intake and dementia in Latin America, China, and India: A 10/66 Dementia Research Group population-based study. *Am J Clin Nutr* **90**, 392-400.
[21] Grant WB (2014) Trends in diet and Alzheimer's disease during the nutrition transition in Japan and developing countries. *J Alzheimers Dis* **38**, 611-620.
[22] Hall KS, Hendrie HC (2012) Early childhood environment and dementia. *Lancet* **380**, 11-12.
[23] Wu YT, Lee HY, Norton S, Chen C, Chen H, He C, Fleming J, Matthews FE, Brayne C (2013) Prevalence studies of dementia in mainland China, Hong Kong and Taiwan: A systematic review and meta-analysis. *PLoS One* **8**, e66252.
[24] Food and Agriculture Organization of the United Nations. FAOSTAT. http://faostat.fao.org/site/368/default.aspx#ancor, accessed April, 2014.
[25] Wu YT, Lee HY, Norton S, Prina AM, Fleming J, Matthews FE, Brayne C (2014) Period, birth cohort and prevalence of dementia in mainland China, Hong Kong and Taiwan: A meta-analysis. *Int J Geriatr Psychiatry*, doi: 10.1002/gps.4148
[26] Erkinjuntti T, Østbye T, Steenhuis R, Hachinski V (1997) The effect of different diagnostic criteria on the prevalence of dementia. *N Engl J Med* **337**, 1667-1674.
[27] Chen R, Ma Y, Wilson K, Hu Z, Sallah D, Wang JJ, Fan LH, Chen RL, Copeland J (2012) A multicentre community-based study of dementia cases and subcases in older people in China — the GMS-AGECAT prevalence and socio-economic correlates. *Int J Geriatr Psychiatry* **27**, 692-702.
[28] Chan KY, Wang W, Wu JJ, Liu L, Theodoratou E, Car J, Middleton L, Russ TC, Deary IJ, Campbell H, Wang W, Rudan I (2013) Global Health Epidemiology Reference Group (GHERG), Epidemiology of Alzheimer's disease and other forms of dementia in China, 1990–2010: A systematic review and analysis. *Lancet* **381**, 2016-2023.
[29] Alzheimer's Disease International (2013) The global impact of dementia 2013-2050. Available: http://www.alz.co.uk/research/GlobalImpactDementia2013.pdf
[30] Hu N, Yu JT, Tan L, Wang YL, Sun L, Tan L (2013) Nutrition and the risk of Alzheimer's disease. *Biomed Res Int* **2013**, 524820.
[31] Morris MC, Tangney CC (2014) Dietary fat composition and dementia risk. *Neurobiol Aging* **35**(Suppl 2), S59-S64.
[32] Solfrizzi V, Frisardi V, Capurso C, D'Introno A, Colacicco AM, Vendemiale G, Capurso A, Panza F (2010) Dietary fatty acids in dementia and predementia syndromes: Epidemiological evidence and possible underlying mechanisms. *Ageing Res Rev* **9**, 184-199.
[33] Lai HK, Tsang H, Thach TQ, Wong CM (2013) Health impact assessment of exposure to fine particulate matter based on satellite and meteorological information. *Environ Sci Process Impacts* **15**, 239-246.
[34] Hu Z, Rao KR (2009) Particulate air pollution and chronic ischemic heart disease in the eastern United States: A county level ecological study using satellite aerosol data. *Environ Health* **8**, 26.
[35] Ailshire JA, Crimmins EM (2014) Fine particulate matter air pollution and cognitive function among older US adults. *Am J Epidemiol* **180**, 359-366.
[36] Weuve J (2014) Invited commentary: How exposure to air pollution may shape dementia risk, and what epidemiology can say about it. *Am J Epidemiol* **180**, 367-371.